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## HOW DOES AGRICULTURAL DEVELOPMENT AFFECT CHILD NUTRITION IN MALI?



by

Christopher L. Penders, John M. Staatz, and James F. Tefft

Food Security II Cooperative Agreement between U.S. Agency for International Development, Global Bureau, Economic Growth Center, Office of Agriculture and Food Security, and Department of Agricultural Economics, Michigan State University



**Malian  
institutions**

**OBJECTIVES:** The objective of this policy synthesis is to identify the pathways through which agricultural development can affect child malnutrition and to analyze the strength of these relationships. Specifically, this synthesis explores the impact of the following variables on child malnutrition:

- Income
- Maternal education
- Community infrastructure
- Staple food prices
- Changes in female labor participation in agriculture

Regression analysis is used to examine the effects of these variables on weight-for-height and height-for-age Z scores in the two recent studies of child health and nutrition in Mali.

**FINDINGS:** Overall, this research suggests that links between agriculture and child malnutrition, particularly through changes in income and infrastructure, are generally positive but weak. These findings are consistent with other studies of child malnutrition in Africa. Malnutrition appears to be related less to the household's means and determined more by other behavioral phenomena, such as feeding practices and health and sanitation.

According to the World Health Organization, malnutrition is the direct result of inadequate dietary intake, disease, and the interaction of these two factors. Weight-for-height Z scores (WHZ) are a short-term indicator of malnutrition, whereas height-for-age Z scores (HAZ) represent a longer-term measure of poor health and nutrition.

The data analyzed were collected in Mali by Macro International, along with CERPOD, MSPAS, and the DNSI, as part of the Demographic and Health Surveys conducted in 1987 (DHS I) and 1995/96 (DHS II). Children included in this analysis are between 6 and 35 months. Descriptive analysis reveals that the two studies are representative of different sample populations; consequently, they are analyzed separately. In particular, the DHS I sample is wealthier, more educated, and has a higher portion of urban residents.

**Income:** Income is approximated by household ownership of various assets: radios, bicycles, motorcycles, televisions, refrigerators, and cars. The control group is the set of households owning none of these assets, and the effects of higher incomes are estimated by groups owning one, two and three or more assets.



There are no significant effects of income on WHZ scores for the DHS I sample. However, there is a positive and statistically significant relationship between income (two and three or more assets) and HAZ scores, particularly for urban households. In the short run, the incidence of disease and other factors are likely to be uncorrelated with household income. Yet, over time, higher incomes should improve nutritional outcomes.

Analysis of the DHS II yields somewhat different results. Income is more strongly correlated with greater WHZ than HAZ scores. Although this result is puzzling, both are positive and significantly related to nutrition. The effects of income on WHZ are largest for rural households, while HAZ is more highly correlated with income in urban households.

Other studies show similar positive but weak associations between income and better child health and nutrition.<sup>1</sup> Often, higher incomes do result in greater expenditures on food, particularly high-priced calories such as meats. However, in the short-run, these effects do not result in better child nutrition.

**Maternal Education:** Some studies find strong links between (formal) maternal education and improved child Z scores. However, other studies, controlling for different factors, show little or no correlation between the two. It is not clear how a few extra years of primary schooling, apart from higher incomes, will change care-giving behaviors.

In this study, mothers are divided into three groups: those with no education, mothers with some primary education, and women with a secondary or higher level of education. Roughly 90% of all rural women have no education, while 40% of urban women do have some formal education.

Both the DHS I and II studies show positive, significant associations between maternal education and WHZ scores. In the first DHS study,

there is a positive and significant relationship of similar magnitudes for both primary and secondary levels of education. In the DHS II study, this effect is strongest for urban mothers with some primary education.

There are no significant effects of maternal education on HAZ scores in either DHS I or II. These results appear somewhat counter-intuitive, since it is expected that education will improve health over time. Moreover, given the significant relationship between education and WHZ, these effects should be present over the long run (HAZ) as well. More analysis is necessary, particularly of the health and nutritional content of education, before further conclusions are drawn.

**Community Infrastructure:** The effects of community infrastructure on child health and nutrition are analyzed using only the DHS II sample. (The community questionnaire was omitted from earlier DHS studies.) Infrastructure variables indicate the presence of adult literacy centers, primary and secondary schools within 2 kilometers of the central village,<sup>2</sup> basic and advanced health care facilities within 2 km and between 3 and 15 km of the central village, and community health agents providing oral-rehydration therapy (WHZ) and vitamin A (HAZ).

Overall, the effects of various types of community infrastructure on WHZ scores are mixed. The presence of a basic health facility within 15 km is positively associated with WHZ scores, while a secondary school within 2 km is negatively associated with better nutrition in the short run.

The presence of a community infrastructure is generally associated with higher HAZ scores. The magnitude of this effect is largest for secondary schools within 2 km and basic health facilities within 15 km of the central village. Advanced health facilities within 15 km are negatively related to HAZ scores; however, this may indicate

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<sup>1</sup>See Policy Synthesis No. 52: Agricultural Development and Child Malnutrition: What Do We Know?

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<sup>2</sup>The “central” village references the largest village within a cluster of villages studied by the DHS II.



that these facilities are too far away, and may not be geared to addressing basic health and nutrition.

The results from this analysis are not surprising given the relationship between short and long run health and nutrition. Other studies report similar positive, although mixed, results. It is difficult to compare findings because the quality of facilities may differ and distances between villages and facilities also vary widely.

**Staple Food Prices:** The effects of staple food prices on child health and nutrition are ambiguous and cannot be interpreted clearly. Further analysis with detailed information on sales and purchases, in addition to production, is necessary before any conclusions can be drawn.

Staple food prices include millet, sorghum, rice, and maize. Analysis of WHZ scores uses weekly average prices from local markets during the month of measurement. However, it is not known if households bought grain during this period, nor which grain was purchased. Thus, it is not known what prices are actually faced by these households. Furthermore, it is not known whether the household was a net buyer or seller of grain. Higher food prices have different effects, depending on a household's position in the market; for net sellers, higher prices raise income, while net buyers may reduce consumption.

Most studies do not have access to useful price information. Those studies that do typically analyze food consumption and nutrient intake, rather than child health and nutrition. In fact, the strength of the relationship with food prices often depends on the method of data collection. Studies that analyze consumption usually show stronger links to food prices than studies that collect intake.

**Women's Labor Allocations:** It is hypothesized that the increasing participation of women in agriculture may have deleterious effects on children. In particular, women who work in agriculture during the third trimester of pregnancy may have children who are more likely to suffer from intrauterine growth retardation. These

children will be at a relative disadvantage to children born during other times of the year.

Increased agricultural labor by women may also reduce the time spent caring for children and decrease time allocated to food preparation (or reallocate these activities to young girls in the household). Moreover, women may have less time to devote to other income-generating activities that can earn money which may be spent directly on food. Increased agricultural activity by women could also raise incomes enough to offset these negative impacts.

Variables were used to control for children born following the weeding season and for those born following the harvest. If these children are at a disadvantage relative to others, then HAZ scores should be somewhat smaller. Tests of this relationship first analyzed children in the rural areas of Sikasso and Koulikoro, where agricultural development has clearly been occurring over the past decades. These results are then compared with all children living in rural areas born during the same months, and all children in the study born during these months.

At this time, there is no evidence of any adverse consequences on height-for-age from agricultural development. The results of these tests, contrary to the hypothesized relationship, show a weak positive association between HAZ and third trimester gestation during weeding and harvest seasons. This is by no means a conclusive test of this hypothesis. A more appropriate test would examine birth weights following these seasons. Due to the timing of the DHS II study during the dry season, tests of birth weight or WHZ were not possible.

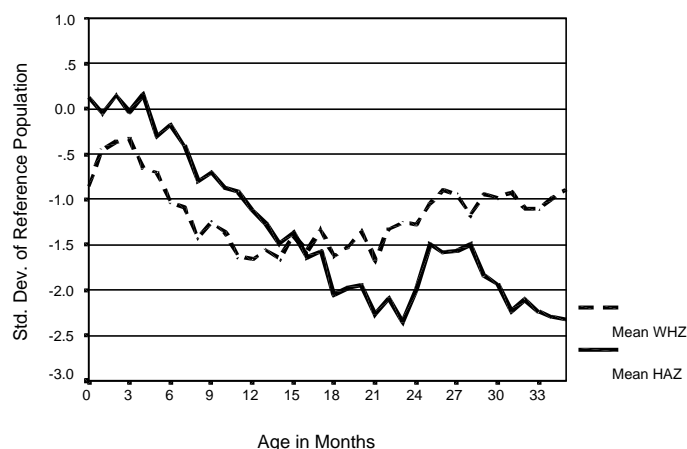
A study of the effects of agricultural commercialization on child nutrition in Zambia found substantial seasonal variation. According to the researchers, child WHZ scores were significantly lower during the period of weeding than other times of the year, and women provide two-thirds of the labor allocated to weeding. These effects were not observed on HAZ.



**POLICY IMPLICATIONS:** Agriculture, to the extent that it raises income and improves infrastructure, can improve the health and nutrition of children. However, these effects by themselves may be minor in the short- to medium-term (1 to 5 years). Decision makers need to continue to seek new policies that can exploit the links between agriculture, through income and infrastructure, and nutrition. For example, the profit sharing arrangement between cotton farmers and CMDT affords villages with the opportunity to construct infrastructure, such as new schools and health facilities, that may not have been feasible otherwise. Perhaps policy makers can design interventions that encourage the use of these new facilities, and employ these facilities to increase community outreach on issues of health and nutrition. Further research may be necessary to study the effectiveness of current health and nutritional activities and analyze the financial sustainability of these facilities.

Ultimately, economic analysis of child health and nutrition offers limited insight into the basic causes of this problem. From Figure 1, it is clear that malnutrition is intimately associated with the age of the child. In fact, variables controlling for the age of the child accounted for most of the variation in WHZ and HAZ scores.

**Figure 1. Average WHZ and HAZ Scores for Malian Children by Age in Months**



Source: Demographic and Health Survey, 1995/96

Detailed analysis of behavior within the household is necessary before the patterns in height-for-age and weight-for-height can be fully explained. Such analysis will require a holistic, interdisciplinary approach from researchers in economics, public health, and other fields. Many studies already collect a wide range of information germane to malnutrition from different perspectives. However, none of these studies present researchers with enough detail to fully analyze underlying causes.

It is more prudent for researchers, government ministries, and donor organizations to share information and conduct research on shared samples to more successfully analyze nutrition and inform policy. For example, sharing samples from the upcoming DHS study with the agricultural survey run by CMDT, the upcoming World Bank micro-nutrient study and a proposed Budget-Consumption study would provide researchers with a much more holistic view of the underlying determinants of child malnutrition in Mali.

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Penders and Tefft are visiting specialists, and Staatz is professor in the Department of Agricultural Economics at Michigan State University. The views expressed in this document are exclusively those of the authors.